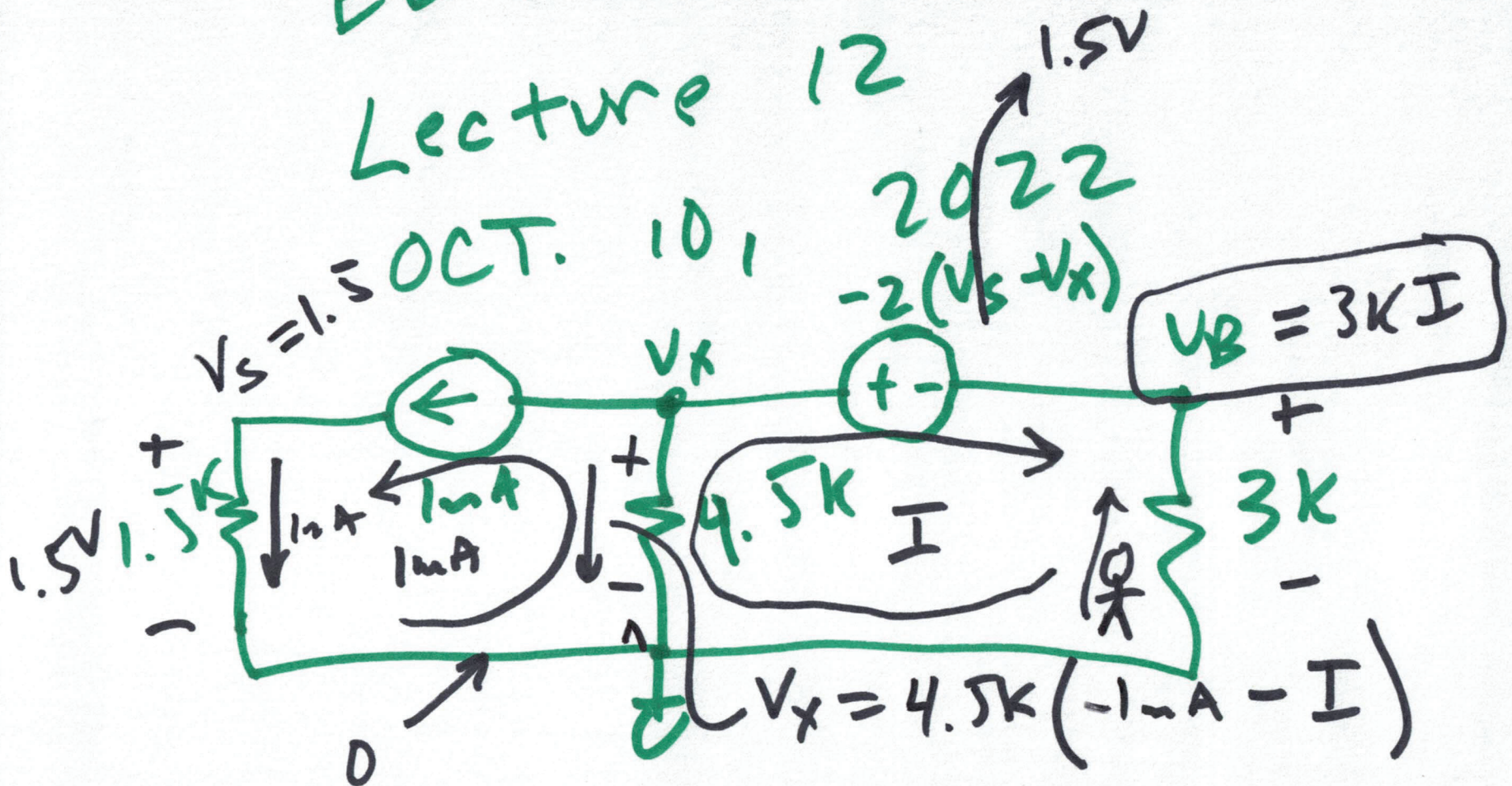


# EE 220 circuits I

Lecture 12

OCT. 10, 2022



$$3k \cdot I + (-2(1.5 - V_x)) - V_x = 0$$

$$3kI - 2(1.5 + 4.5k(1mA + I)) + 4.5k(1mA + I) = 0$$

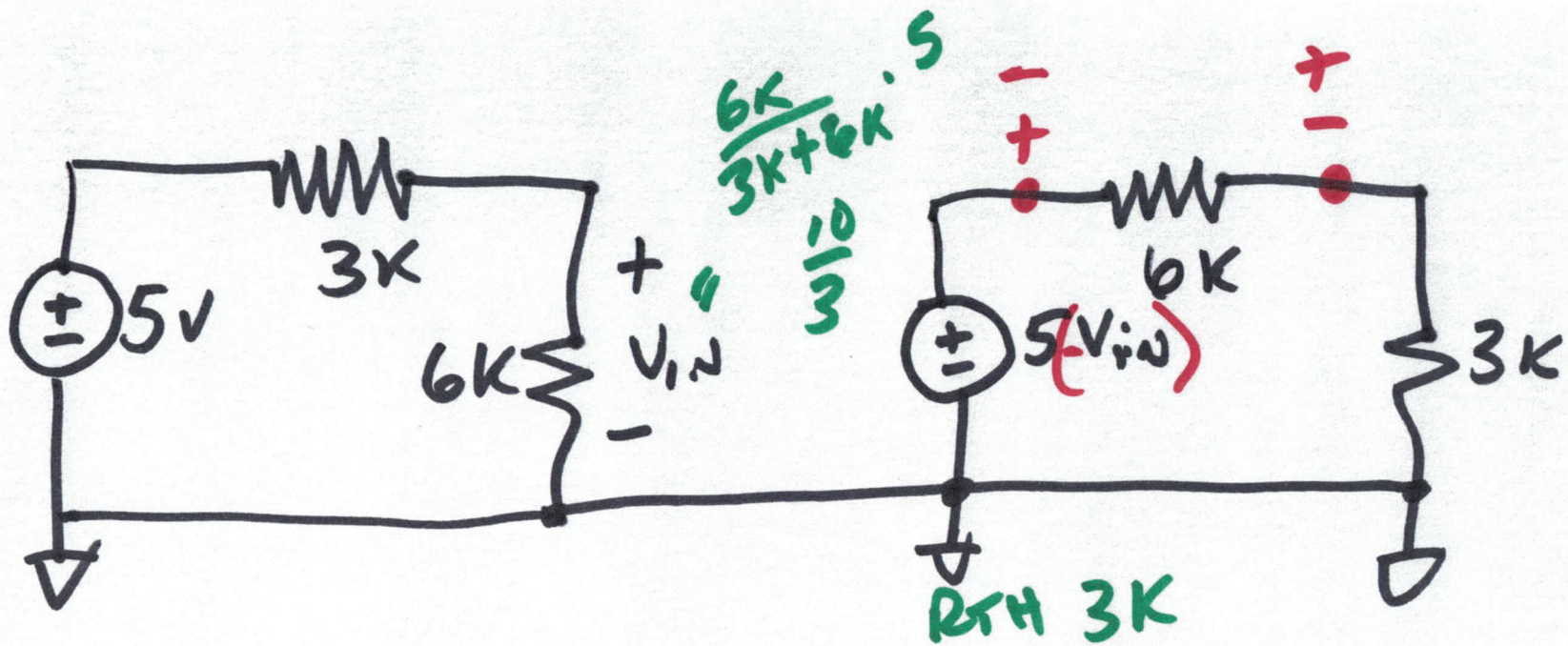
$$0 = 3kI - 3 \cdot \frac{9}{k} (1mA + I) + 4.5 + 4.5kI$$

$$= 3kI - 3 - 9 - 9kI + 4.5 + 4.5kI$$

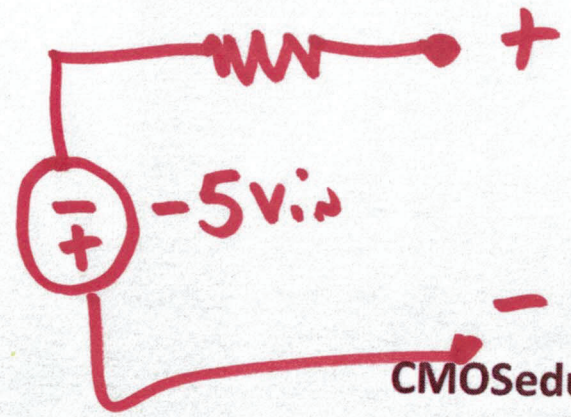
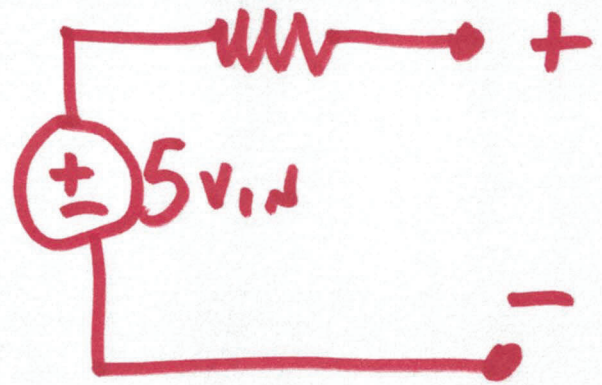
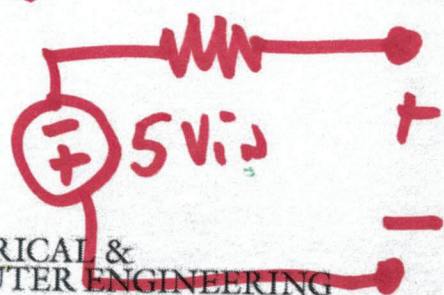
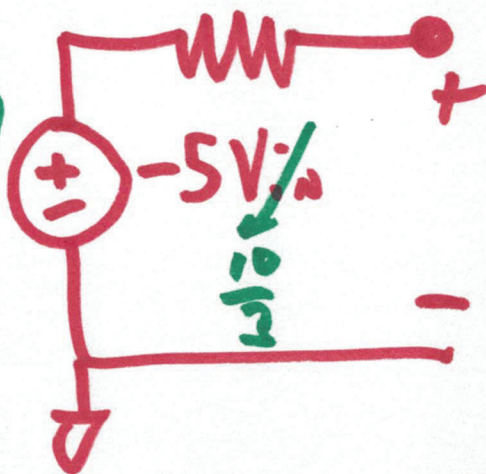
$$0 = -1.5kI + (-7.5)$$

$$I = -\frac{7.5}{1.5k} = -5 \mu A$$

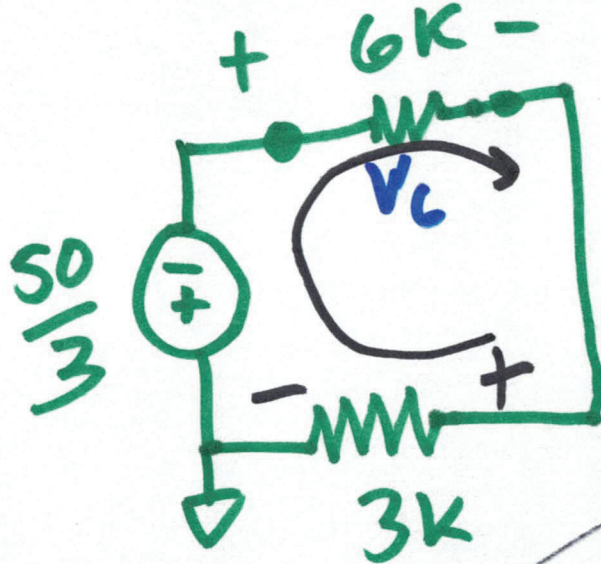
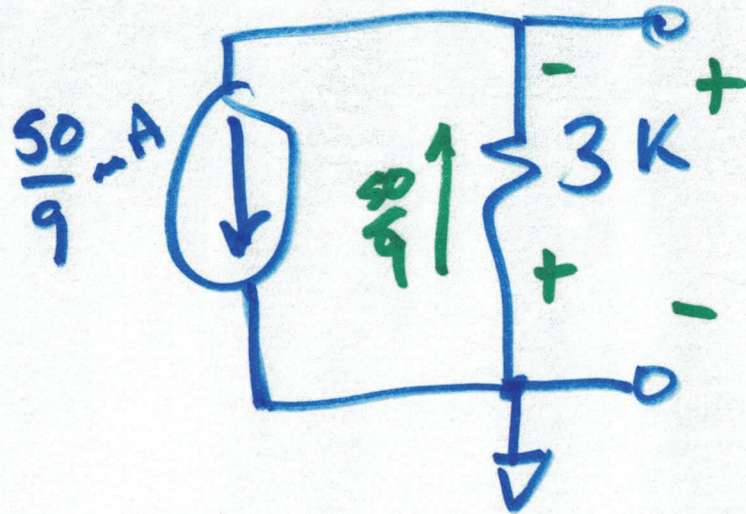
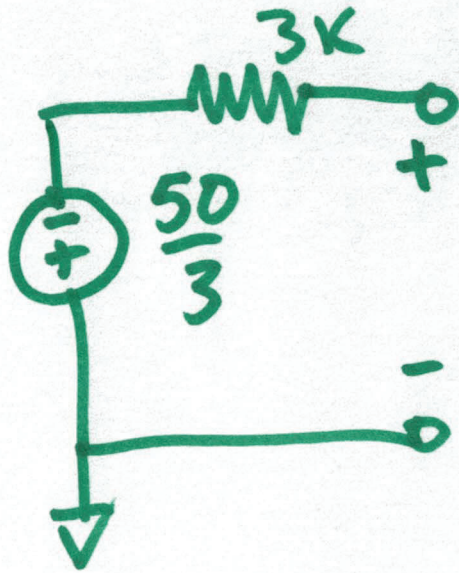
$$V_B = 3kI = -15V$$



$\frac{3}{3} = 16.667$



3)



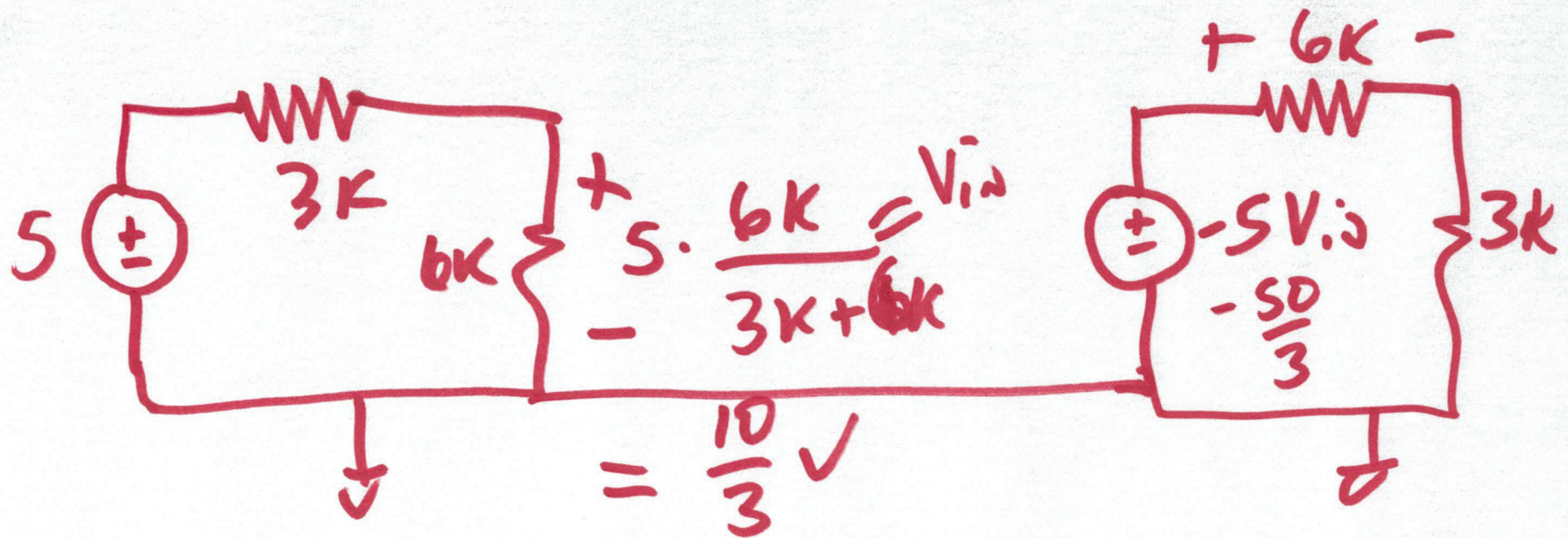
$$V_6 = -\frac{50}{3} \cdot \frac{6}{6+3} = -\frac{100}{9}$$

$$V_6 = 11.11V$$

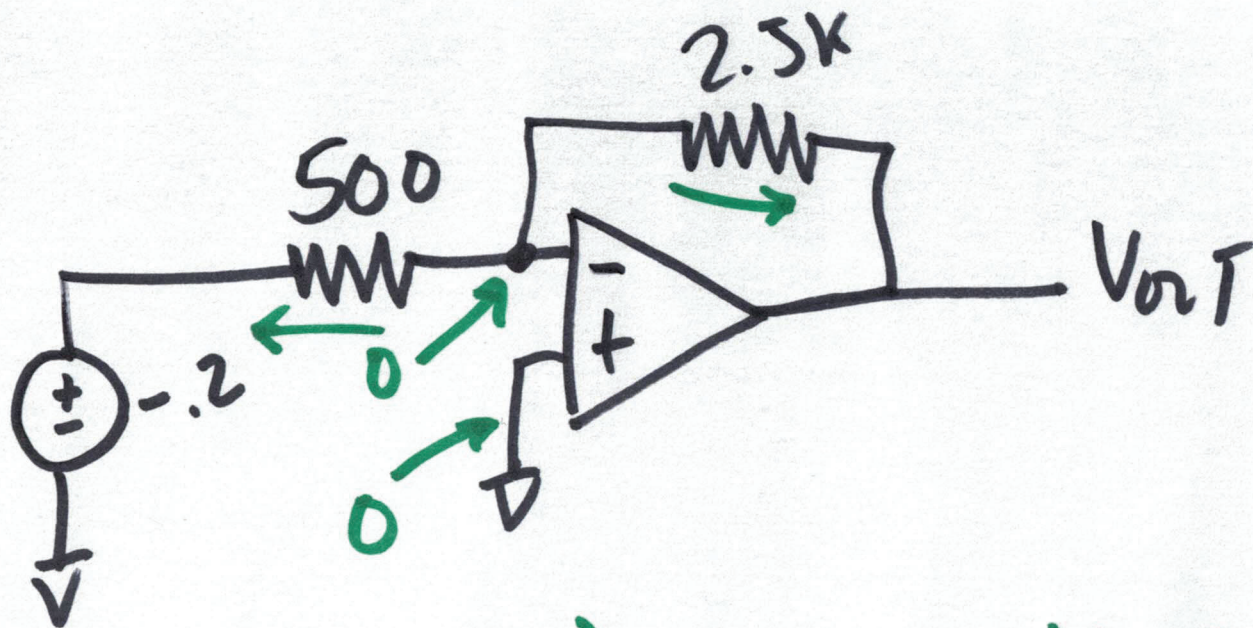
$$V_6 = I \cdot 6k$$

$$-\frac{50}{3} - 6kI - 3k \cdot I = 0$$

$$I = -\frac{50}{3} \cdot \frac{1}{(6+3)k}$$



$$-\frac{50}{3} \cdot \frac{6k}{6k + 3k} = -\frac{100}{9} = -11.11V$$



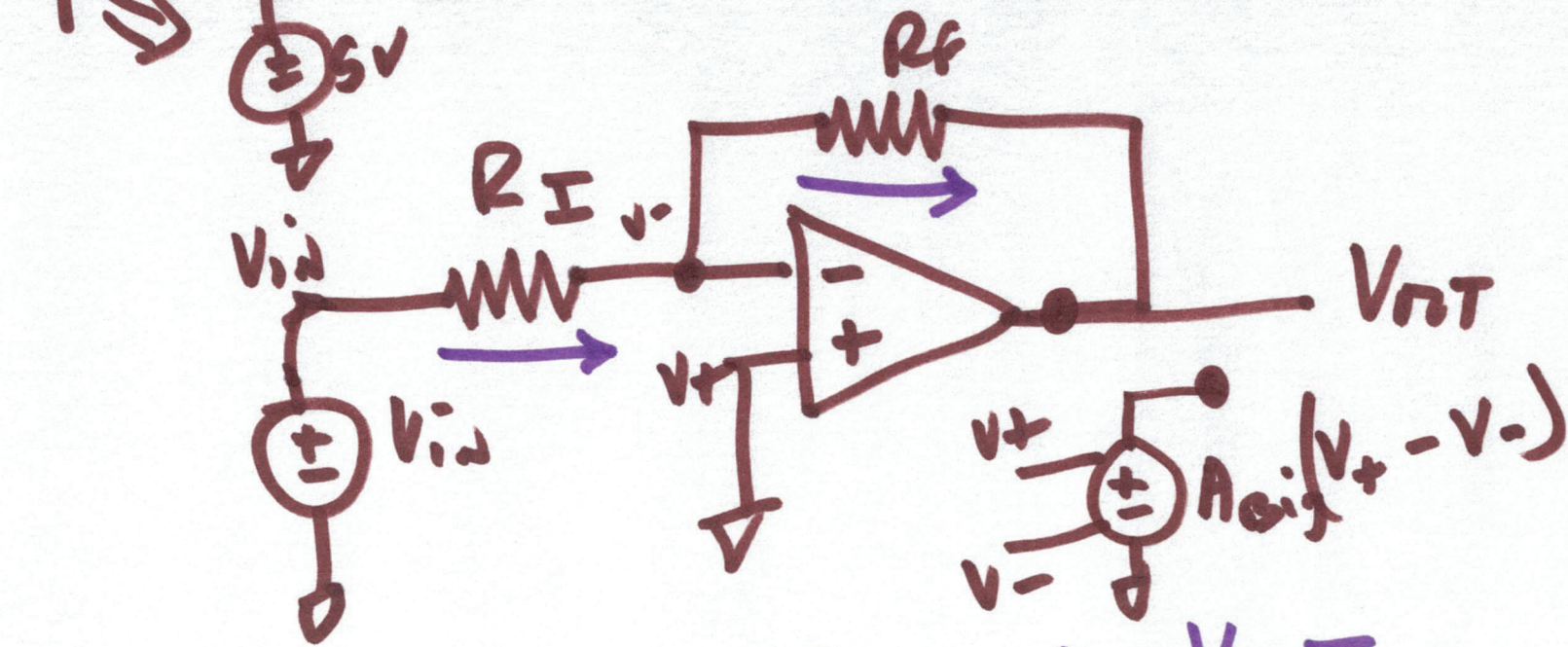
$$\frac{0 - (-0.2)}{500} + \frac{0 - V_{out}}{2.5k} = 0$$

$$5 \times (-0.2) = V_{out}$$

$$V_{out} = 1V$$

6)

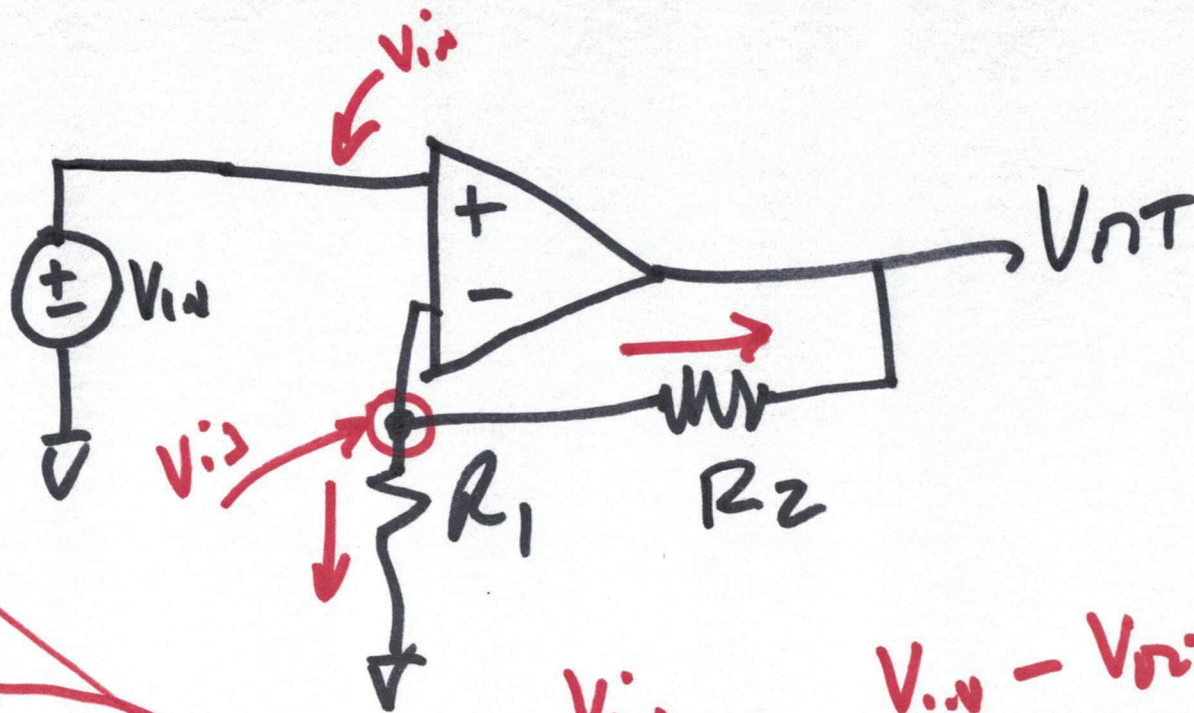
# INVERTING OP-AMP



$$\frac{V_{in} - 0}{R_I} = \frac{0 - V_{out}}{R_F}$$

$$\frac{V_{out}}{V_{in}} = -\frac{R_F}{R_I}$$

# NON-INVERTING OP-AMP



$$\frac{V_{out}}{V_{in}} = 1 + \frac{R_2}{R_1}$$
$$= \frac{R_1 + R_2}{R_1}$$

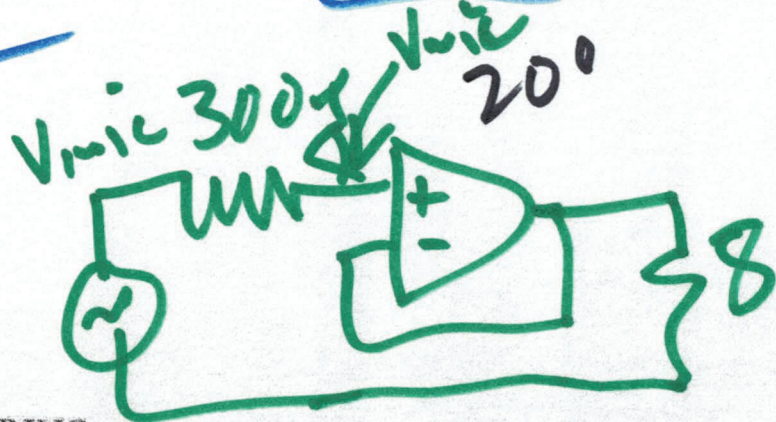
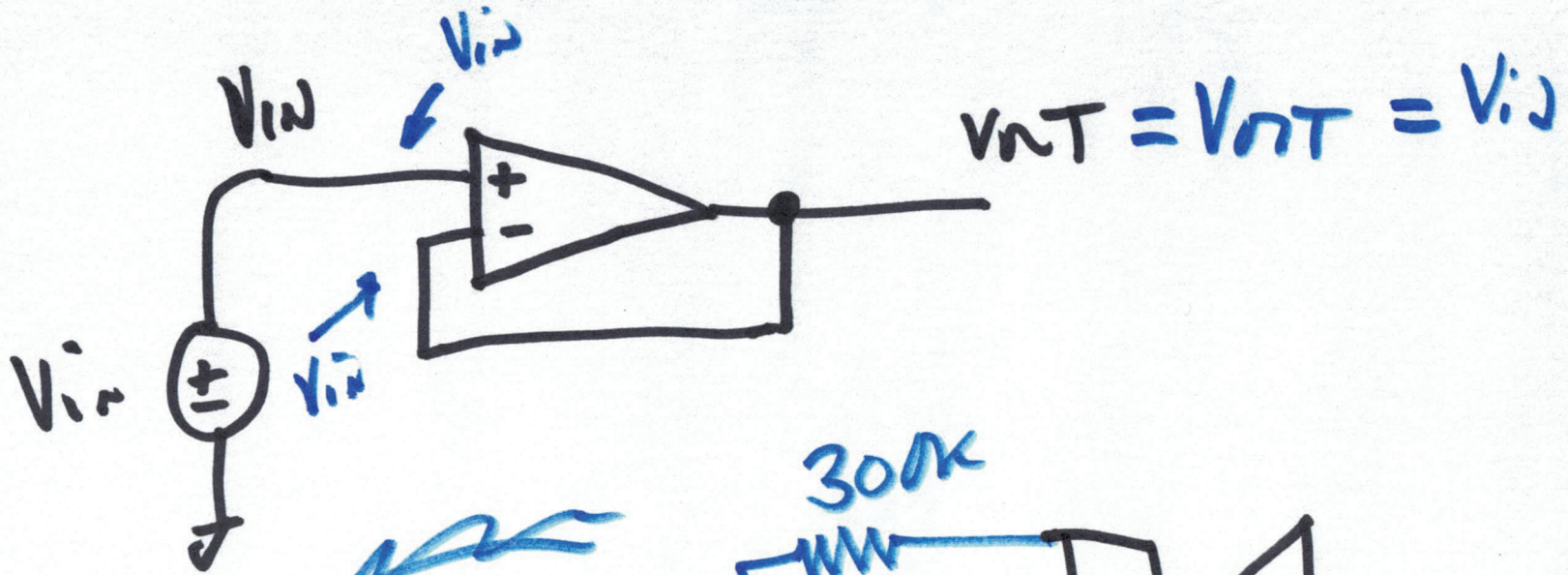
$$\frac{V_{in}}{R_1} + \frac{V_{in} - V_{out}}{R_2} = 0$$

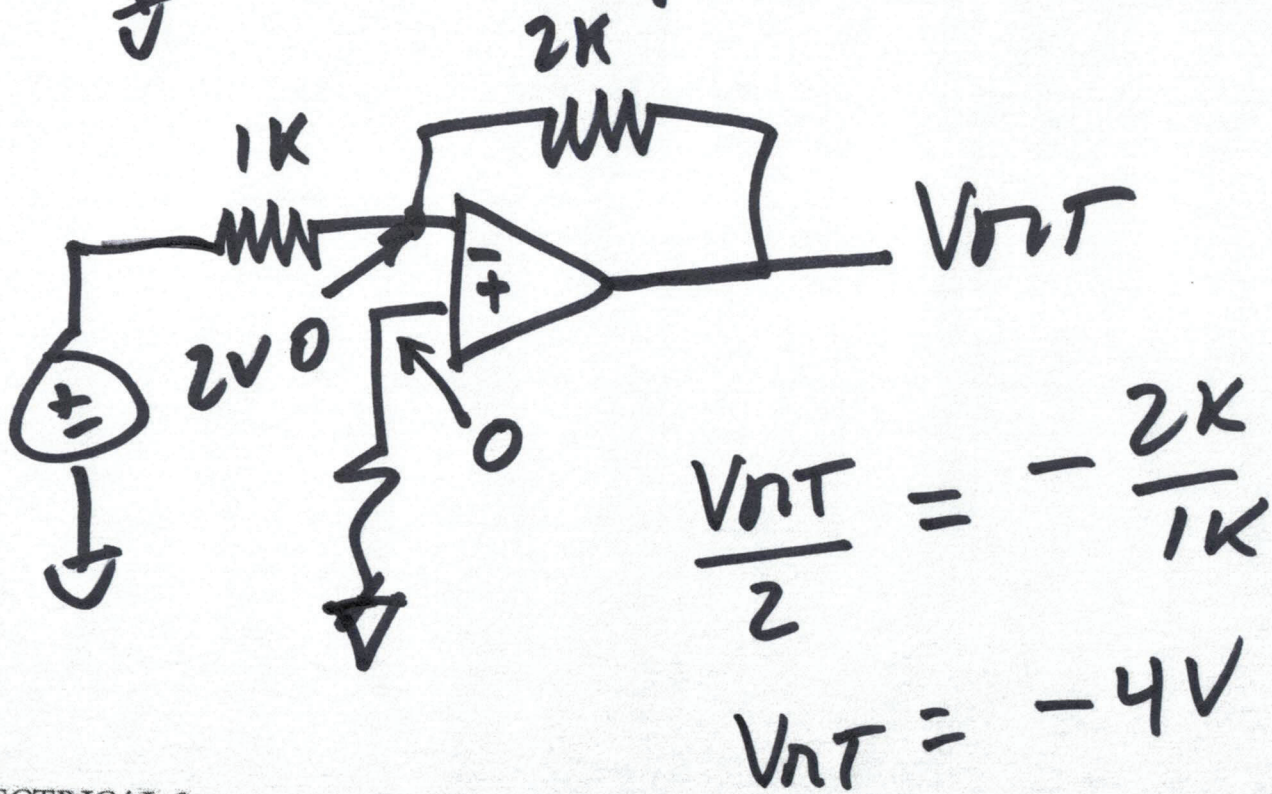
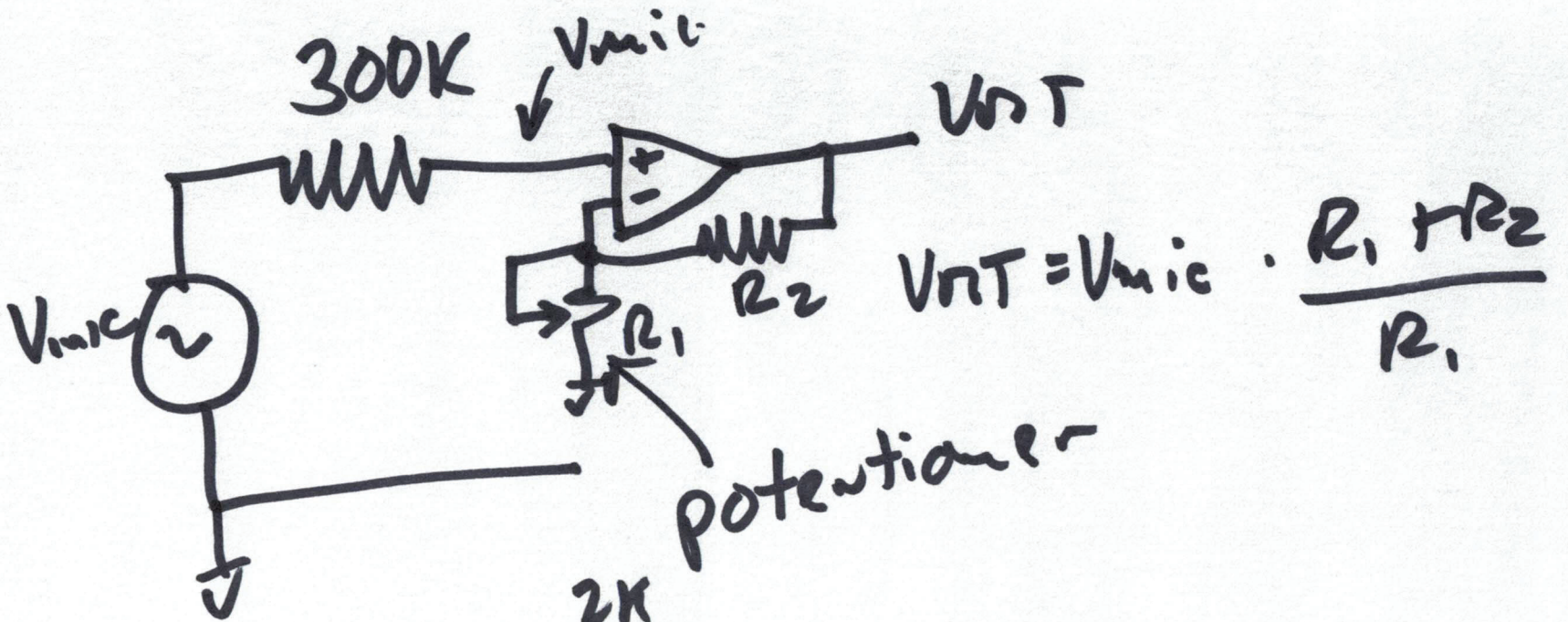
$$V_{in} \left( \frac{1}{R_1} + \frac{1}{R_2} \right) = \frac{V_{out}}{R_2}$$

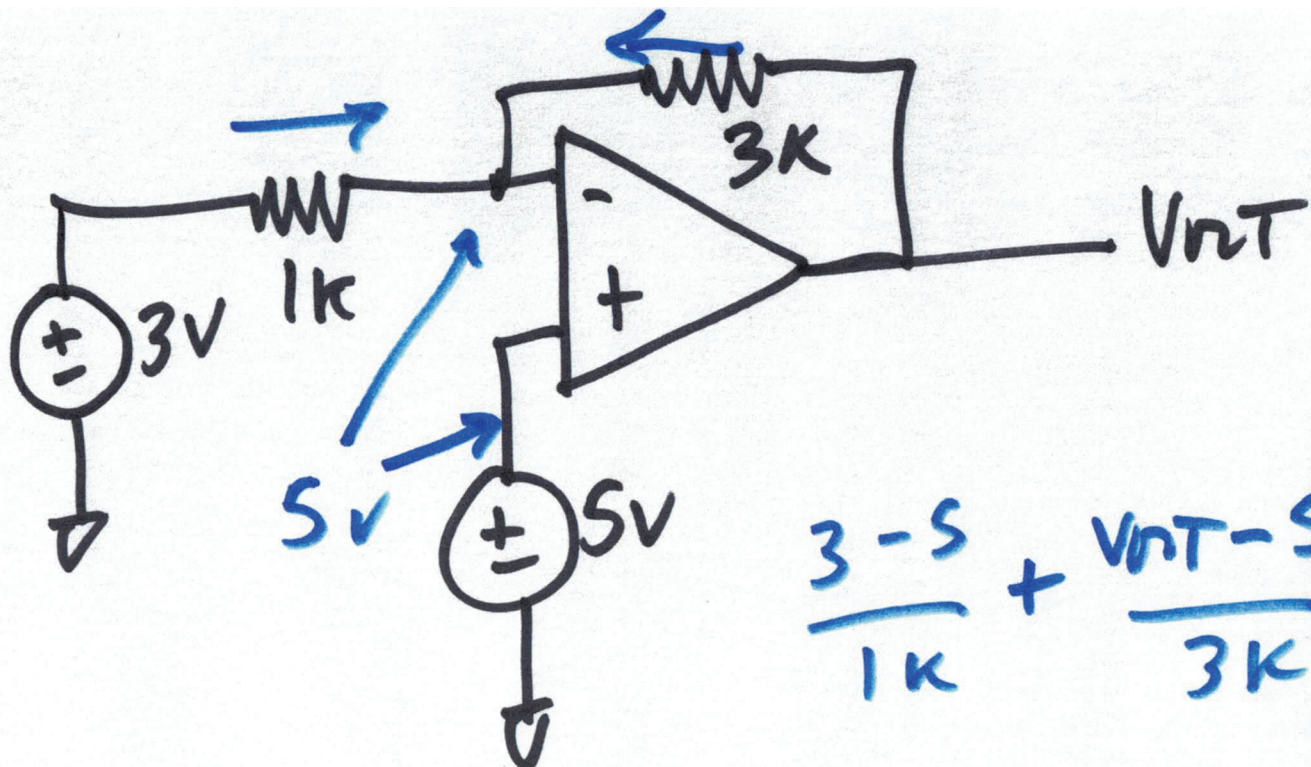
8)



# Voltage follower







$$\frac{3-5}{1k} + \frac{V_{out}-5}{3k} = 0$$

$$9-15 + V_{out} - 5 = 0$$

$$V_{out} = 11V$$